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FIRST REPORT OF *COENOSIA ATTENUATA* STEIN (DIPTERA: MUSCIDAE), AN OLD WORLD 'HUNTER FLY' IN NORTH AMERICA

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Abstract.—The Palearctic muscid *Coenosia attenuata* Stein is reported for the first time in North America based on collections from the U.S.A. and Canada. Adult flies were collected from commercial greenhouses in Erie, Monroe, Onondaga, Suffolk, Tompkins, and Wayne counties of New York State and Ontario Province, Canada, and from a Malaise trap in a suburban backyard of Los Angeles County, California. A diagnosis, redescription, and photographs of the adult are provided to help distinguish it from other North American Muscidae. Its biology and habits are summarized from the European literature, and its Old World distribution is reviewed.

Key Words: Diptera, Muscidae, *Coenosia attenuata*, North America, immigrant species, new record, New York, California, Ontario

In late August of 2002, several specimens of a small muscid fly, collected by EJS in a greenhouse in East Syracuse, New York, were submitted to ERH for identification. They proved to be *Coenosia attenuata* Stein, an obligatory predaceous fly indigenous to the Paleotropical Region and not known to occur in North America.

In this paper, we give the first North American records for *C. attenuata*, review the Old World literature treating this species, provide notes on its biology and habits, and redescribe and provide photographs of the adult to enable recognition of this species in the North American fauna.

Specimens of *C. attenuata* were first noticed in early October 1999 by Elise Schillo-Lobdell, an IPM scout, at a commercial greenhouse specializing in the large-scale production of poinsettias. It was at this same greenhouse where specimens were later collected by EJS on 28 August 2002 and identified by ERH.

Since this initial collection, numerous other specimens have been collected on yellow sticky card-traps set for monitoring pest populations (including shore flies and fungus gnats) in other greenhouses across New York as well as at a site in Ontario, Canada. Quite by accident and about the same time, the senior author also learned from Dr. Adrian Pont, a muscid fly specialist from Great Britain, that he had recently identified specimens of *C. attenuata* from California; these specimens were collected from a Malaise trap in a suburban backyard in Los Angeles County in mid-September of 2002 (Brian V. Brown, personal communication).

Coenosia attenuata Stein
(Figs. 1–4)
(Synonymy after Pont 1986)

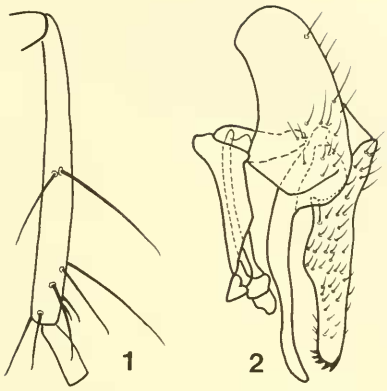
Coenosia attenuata Stein *in* Becker 1903: 121.
Coenosia (*Caricea*) *flavicornis* Schnabl *in* Schnabl and Dziedzicki 1911: 80.
Coenosia confalonierii Séguy 1930: 86.
Coenosia (*Caricea*) *affinis* Santos Abreu 1976: 13.
Coenosia (*Caricea*) *flavipes* Santos Abreu 1976: 13.

Diagnosis.—*Coenosia attenuata* is a member of the nominate subgenus *Coenosia* Meigen (*sensu* Huckett 1934) or the *tigrina*-group (*sensu* Hennig 1961), characterized by the hind tibia with two closely adjacent bristles at the middle, situated on the anterodorsal and anterior surfaces respectively (illustrated by Hennig 1961: 521, fig. 210B, and Fig. 1, herein). The Old World species *C. tigrina* F., *C. atra* Meigen, *C. humilis* Meigen, and *C. strigipes* Stein also belong to this *tigrina*-group, occasionally placed in its own genus *Caricea* Robineau-Desvoidy (Skidmore 1985); all are members of the greenhouse predator community (Kühne 2000), and are occasionally referred to by Old World workers as either "hunter flies" or "killer flies." *Coenosia tigrina* and *C. humilis* are recorded from North America (see remarks). From these two introduced species, *C. attenuata* can be easily differentiated by its smaller size (2.5–3.0 mm, male; 3.0–4.0 mm, female) (vs. 4.75–5.75 mm, male and 5.75–7.0 mm, female for *C. tigrina*; and 3.0–3.5 mm, male and 3.0–5.5 mm, female for *C. humilis*; measurements from d'Assis Fonseca 1968), legs of the male entirely pale yellow (vs. femora mostly black but broadly reddish yellow at apex in male of *C. tigrina*, and femora entirely black in male of *C. humilis*), and the distinctive male genitalia (Fig. 2).

Redescription [terminology for structures follows McAlpine (1981)]. Male and female habitus, Figs. 3–4. Redescribed from 29 specimens (East Syracuse, Onondaga Co., NY). Length: 2.5–3.0 mm, male (n = 20); 3.0–4.0 mm, female (n = 9).

Male.—*Head:* Parafacial, fronto-orbital plates, frontal vitta, and face silvery-white pruinose, with yellowish tinge; black ground color not visible under pruinosity except slightly on face. Pedicel silvery-white pruinose (with yellow tinge), black ground color visible at extreme base. Flagellomere 1 also silvery-white pruinose (with yellow tinge). Aristomere 1 very short; aristomere 2 not more than 2× as long as wide; aristomere 3 very long, evenly tapered to fine tip, with dense short hairs on basal half, longest of which equal basal diameter of aristomere 3. Orbital plate with 3 strong setae: lower and middle setae lateroclinate; upper seta reclinate. Ocellar and postocellar setae well developed. Inner vertical setae strong, parallel. Parafacial and facial ridge bare. Lower facial margin protruding slightly just below vibrissa when viewed in profile. Maxillary palpus yellow, slightly clavate apically, moderately haired.

Thorax: Black in ground color, except dorsum of scutum and scutellum light gray pruinose, with slight metallic blue tinge scarcely visible. In some specimens, 3 indistinct brownish lines or stripes visible on scutum. Acrostichal setae small to medium, arranged in roughly 2 irregular rows; approximately 4–6 presutural setae, and 6–8 postsutural setae. One strong presutural dorsocentral seta. Three strong postsutural dorsocentral setae. Two medium intra-alar setae. Two (one small, one strong) postalar setae. One strong supra-alar seta. Scutellum with one pair of strong crossed apical setae, one pair of strong subapical setae, and one pair of small basal setae. Dorsum of scutellum with several small discal setae. Anepisternum with at least 4–5 setae, 2 of these strong and extended to margin of lower calypter. Katepisternum with three strong setae. Wings with veins r_{4+5} and m parallel to margin. Halter yellow. Legs entirely yellow; tarsi appearing darker due to dense covering of numerous small black setulae.



Figs. 1–2. *Coenosia attenuata*. 1, Hind tibia. 2, Male genitalia (epandrium, cerci, and surstylus). Both figures redrawn from Hennig (1961: Textfig. 210B, p. 521 and Taf. XXVIII, fig. 533).

Hind tibiae with two closely adjacent bristles at middle, situated on anterodorsal and anterior surfaces respectively (Fig. 1).

Abdomen: Short, ovoid. T_{1+2} to T_5 dark gray pruinose, without dark maculations. All tergites with numerous small to medium discal and marginal setae. Epandrium of terminalia gray pruinose, cercus and surstylus yellow to orangish.

Male terminalia (Fig. 2): As illustrated by Hennig (1961: Taf. XXII, fig. 453; Taf. XXVIII, fig. 533) and Cui (1999: 929, fig. 2137).

Female.—Similar to male in most respects, except larger in size, and in coloration of head, antenna, and legs. Frontal vitta (not silvery-white pruinose as in male) generally dark with metallic blue-green pruinosity. Antenna darkened. Legs black (with gray pruinosity), except trochanters, extreme bases and apices of femora, tibiae, and tarsi yellowish.

Remarks.—Two other species of the *tigrina*-group are known from North America, both presumably introduced in the early to mid 1800s. *Coenosia tigrina* was first reported in North America by Walker (1849), who originally described it as a new species (*C. sexmaculata*), from Hudson Bay, Ontario (later synonymized with *C. tigrina* by Stein 1901). Its known geographic distribution is decidedly disjunct, occurring from British Columbia and Alberta to California in the west and from northwestern Ontario and Quebec to Michigan and Maine in the east (Huckett 1965). *Coenosia humilis* is widely distributed in North America, ranging from Washington to California and Colorado, and from Wisconsin and Illinois to Quebec and New Jersey (Huckett 1934, 1965). Huckett (1934) reported that the latter species occurs frequently in greenhouses.

Biology, habits, and immature stages.—In Europe, *Coenosia attenuata*, along with *C. atra*, *C. humilis*, *C. strigipes*, *C. tigrina*, and *C. testacea* Robineau-Desvoidy, are members of a greenhouse predator community (Kühne et al. 1994, Kühne 2000). These predaceous flies not only colonize greenhouses from the outside environment, but may also complete their development in greenhouse soil and become established there for long periods of time (Kühne 2000).

Both the larval and adult stages of *C. attenuata* are predaceous. Larvae have been mass reared on dipterous larvae of two taxa: *Bradysia difformis* Frey (= *paupera* Tuomikoski) (Sciaridae) (Kühne 2000) and *Scatopse transversalis* Loew (Scatopsidae) (Kühne 2000). The prey spectrum of adult *C. attenuata* in greenhouses in Baden-Württemberg, Germany, includes the greenhouse pests *Trialeurodes vaporariorum* Westwood and *Bemisia tabaci* (Gennadius) (Aleyrodidae), *Empoasca* sp. (Cicadellidae), and Sciaridae (Schrameyer 1991). Kühne et al. (1997) also recorded Psychodidae, Chironomidae, Ephydridae, and Drosophilidae as prey groups. In captivity, adult *C. attenuata* also consumed the leafminer *Liriomyza huidobrensis* Blanchard (Agromyzidae) (Schrameyer 1991), and the scavenger midge *S. tranversalis* (Kühne 2000).

Figs. 3–4. *Coenosia attenuata*, lateral aspect. 3. Male. 4. Female. Scale line, 1 mm.

According to Schrameyer (1991), adult *C. attennata* employ a sit-and-wait strategy and pursue only prey that are in flight. Ambulatory prey are disregarded, even in extremely close proximity. The prey are pursued, caught, punctured with the proboscis, and the liquid body contents ingested. Manipulation of the food is accomplished by specialized mouthparts. A projection on the mid-labellum forms a daggerlike tooth to puncture prey, and 4–5 "teeth" and a raspy "tongue" structure tear the cuticle of the prey and mechanically grind it for ingestion (Kühne 2000). The daily capture of a single *C. attennata* adult appears to be independent of its age. When food is in short supply, both adults and larvae may become cannibalistic (Kühne 2000).

In the laboratory, the adult reproductive behavior and duration of the developmental stages have been studied by Kühne et al. (1997) and Kühne (2000). The pre-oviposition period is approximately 4 days (Kühne et al. 1997), and most eggs are laid within a three week period at 25° C (Kühne 2000). The eggs of *C. attennata* are of the *Phaonia*-type, *sensu* Ferrar (1987), and require a developmental period of 6.9 days at 21° C and 5.7 days at 25° C (Kühne et al. 1997). The number of larval instars has not been directly determined for *C. attennata*. On the basis of morphological data, however, Kühne (2000) suggests that the larva emerges from the egg as a third instar. LeRoux and Perron (1960) found this phenomenon also to be true for *C. tigrina*; based on morphological evidence and the fact that larvae do not molt during larval life, they concluded that for this species the larvae emerge from the egg in the third instar. Complete larval development for *C. attennata* requires 15.4 days at 21° C and 10.4 days at 25° C, while the pupal stage averaged a duration of 15.9 days at 21° C and 10.5 days at 25° C (Kühne et al. 1997). The maximum adult lifespan is as long as 7 weeks in captivity, but only ca. 50% of captive populations survive longer than 3 weeks (Kühne et al. 1997).

Distribution.—*Coenosia attennata* is reported from southern Europe (Germany, France, Spain, Italy, Greece, Malta, Cyprus); Asia (Syria, Iraq, Israel, Tajikistan, Afghanistan); North Africa (Morocco, Algeria, Libya, Egypt); Madeira, Canary Islands; and the Oriental (widespread), Australasian (Papua New Guinea, Australia), and Afrotropical (Cape Verde Islands, Socotra, South Africa) regions (Pont 1986 and A. C. Pont, pers. comm.). Most recently, *C. attennata* has been reported from South America (Ecuador, Peru) (Martínez-Sánchez et al. 2002).

New York, including at least six counties to date (Erie, Monroe, Onondaga, Suffolk, Tompkins, and Wayne), and California (Los Angeles Co.) in the United States, and Ontario, Canada are new records for North America.

Material examined.—All specimens deposited in the Cornell University Insect Collection, Ithaca, NY, except as noted. UNITED STATES: California: Los Angeles Co., Monrovia, 34.15°N, 117.99°W, 13–14 Sept. 2002, B. V. Brown, ex Malaise trap in suburban backyard (5 ♂, 2 ♀); same data, except 14–15 Sept. 2002 (1 ♂, 4 ♀) (California specimens in the collection of the Natural History Museum of Los Angeles County). New York: Erie Co., Eden, 24 Oct. 2002, E. J. Sensenbach, ex sticky trap (1 ♂). Monroe Co., Gates, 15 Oct. 2002, EJS (1 ♂, 2 ♀). Onondaga Co., East Syracuse, 28 August 2002, EJS and JPS (8 ♂, 7 ♀; of these, 3 ♂ and 3 ♀ in the collection of The Natural History Museum, London, UK); same data, except 12 Sept. 2002, ERH (20 ♂, 9 ♀); same data, except 12 Sept. 2002, EJS, ex sticky cards (2 ♂, 7 ♀). Suffolk Co., Mattituck, 29 Oct. 2002, M. Daughtrey, ex sticky cards (13 ♂, 2 ♀); Riverhead, 29 Oct. 2002, M. Daughtrey, ex sticky cards (2 ♂). Tompkins Co., Lansing, 30 Oct. 2002, W. Nelson, ex sticky cards (2 ♂). Wayne Co., Macedon, 15 Oct. 2002, EJS (1 ♂, 1 ♀); Newark, 15 Oct. 2002, EJS (1 ♂). CANADA: Ontario: Jordan Station, 17 Oct. 2002, G. Murphy, ex sticky cards

(9 ♂, 3 ♀); same data, except 25 Oct. 2002, T. Thiesen (1 ♂, 6 ♀). All specimens taken in New York and Ontario were from commercial production greenhouses.

Mode of introduction.—Because deliberate releases have only been reported in Germany (Kühne 2000), we doubt very strongly that *C. attenuata* was purposefully introduced into North America. According to Stefan Kühne (pers. comm. to EJS), in the last two years rearings of this predator fly have been initiated in Spain, Italy, and Portugal. Moreover, papers by Kühne, and especially K. Schrameyer, suggest these flies are being moved from place to place unintentionally with plant material, although there is no strong evidence to support this hypothesis. We would advocate that potting media are the most likely source for the accidental introduction of *C. attenuata* into North America.

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